

WHAT IS CLAIMED IS:

1                   1.           A data processing system, comprising:  
 2                   a first storage system including a first host and a first storage subsystem, the  
 3 first host having access to a first copy manager, the first copy manager being operable to  
 4 manage a data replication operation;  
 5                   a second storage system including a second host and a second storage  
 6 subsystem, the second host having access to a second copy manager, the second copy manager  
 7 being operable to manage a data replication operation;  
 8                   a first communication link coupling the first storage system and the second  
 9 storage system to exchange management information between the first and second storage  
 10 systems to manage the data replication operation; and  
 11                   a data transfer path configured to transfer data stored in the first storage  
 12 subsystem to the second storage subsystem and replicate the data of the first storage subsystem  
 13 in the second storage subsystem, the data transfer path being different from the first  
 14 communication link.

1                   2.           The data processing system of claim 1, wherein the first  
 2 communication link couples the first and second hosts, the first copy manager of the first host  
 3 using the management information to manage the first storage subsystem for the data  
 4 replication operation, the second copy manager of the second host using the management  
 5 information to manage the second storage subsystem for the data replication operation.

1                   3.           The data processing system of claim 2, wherein the data transfer path  
 2 is a second communication link coupling the first and second storage subsystems.

1                   4.           The data processing system of claim 3, wherein the first and second  
 2 storage subsystems are disk array devices, the first storage subsystem including a first storage  
 3 controller, the first storage subsystem being configured to transmit or receive a data transfer  
 4 request from the second storage subsystem, wherein the first storage subsystem is further  
 5 configured to transfer the data to the second storage subsystem via the second communication  
 6 link upon transmitting or receiving the data transfer request from the second storage  
 7 subsystem.

1                   5.           The data processing system of claim 3 wherein the first storage  
 2 subsystem includes a first storage controller, a first storage area for storing data, and a second

3 storage area for storing a journal, the first storage controller being configured read or write data  
4 into the first storage area according to requests from the first host and update any data image  
5 changes in the first storage area to the second storage area, wherein the storage controller is  
6 further configured to transmit or receive a data transfer request from the second storage  
7 subsystem and transfer the journal from the second storage area to the second storage  
8 subsystem via the second communication link upon transmitting or receiving the data transfer  
9 request from the second storage subsystem.

1           6.           The data processing system of claim 5, wherein the second storage  
2 subsystem includes a second storage controller, a third storage area for storing the journal from  
3 the first storage subsystem, and a fourth storage area for storing data restored using the journal  
4 received from the first storage subsystem, the restored data reflecting the data stored in the first  
5 storage area, the journal including an update journal.

1           7.           The data processing system of claim 6, wherein the second  
2 communication link includes a storage area network, the first and second storage areas being  
3 logical volumes associated with one or more disk drive devices provided in the first storage  
4 subsystem, wherein the journal includes a base journal or a marker journal, or both.

1           8.           The data processing system of claim 6, further comprising:  
2           a third storage system including a third host and a third storage subsystem, the  
3 third host having access to a third copy manager, the third host being coupled to the first host  
4 via the first communication link, the third storage subsystem being coupled to the first storage  
5 subsystem via the second communication link,

6           wherein the third storage system is configured to receive the journal from the  
7 first storage subsystem and obtain the restored data from the journal if the second storage  
8 subsystem is unable to receive the journal or obtain the restored data.

1           9.           The data processing system of claim 8, wherein the first host has an  
2 access to a candidate list including one or more potential storage systems that can receive the  
3 journal and obtain the restored data in place of the second storage system if the second storage  
4 system experiences a failure.

1           10.          The data processing system of claim 1, wherein the first and second  
2 copy managers are asynchronous copy managers, and the first and second storage subsystems

3 are provided in remote locations from each other, and the first communication link and the data  
4 transfer path are the same communication network.

1 11. The data processing system of claim 1, wherein the data transfer path  
2 includes:

3 a first data link coupling the first storage system to a first external storage  
4 device for transferring the data from the first storage system to the first external storage device.

1 12. The data processing system of claim 11, wherein the data transfer  
2 path further includes:

3 a second data link coupling the second storage system to a second external  
4 storage device, the second external storage device configured to receive the data from the first  
5 storage system stored in the first external storage device, so that the data from the first storage  
6 system can be transferred to the second storage system.

1 13. A method for performing a remote replication in a data processing  
2 system including a first storage system including a first host and a first storage subsystem and a  
3 second storage system including a second host and a second storage subsystem, the method  
4 comprising:

5 transmitting a completion notification from the second storage subsystem to the  
6 second host to inform the second host that the second storage subsystem has completed in  
7 receiving first information from the first storage subsystem via a data transfer link coupling the  
8 first and second storage subsystems;

9 receiving at the second storage subsystem a restore command from the second  
10 host to obtain second information corresponding to the first information; and

11 performing the restoration process of the first information at the second storage  
12 subsystem upon receiving the restore command to obtain the second information, the second  
13 information being a copy of data stored in the first storage subsystem,

14 wherein the first and second hosts are coupled to each other via a  
15 communication link to transmit or receive management information relating to the remote  
16 replication method.

1 14. The method of claim 13, further comprising:

2 storing the second information in a first storage area of the first storage  
3 subsystem according to an instruction of the first host;

4                   thereafter, storing the first information corresponding to the second information  
5   in a second storage area of the first storage subsystem; and  
6                   informing the first host that the first storage subsystem is ready to transfer the  
7   first information to the second storage subsystem once a given amount of the first information  
8   is stored in the second storage area,  
9                   wherein a data transfer notification is sent from the first host to the second host  
10   informing the second host that the first storage subsystem is ready to transfer the first  
11   information to the second storage subsystem.

1                   15.       A method for storing data in a storage system, the method  
2   comprising:  
3                   storing data in a first storage area in the first storage subsystem according to an  
4   instruction of a first host associated with the first storage subsystem;  
5                   storing an update journal in a second storage area in the first storage subsystem,  
6   the journal corresponding to the data stored in the first storage area, the journal including  
7   journal data and metadata;  
8                   informing the first host that the first storage subsystem is ready to transfer the  
9   update journal to a second storage system, so that the first host can inform the second storage  
10   system via a first communication link that the first storage subsystem is ready to transfer the  
11   update journal to the second storage system, the first communication link being configured to  
12   exchange management information between the first host and the second storage system; and  
13                   transferring a journal including the update journal to the second storage system  
14   via a data transfer path that is different from the first communication link.

1                   16.       The method of claim 15, wherein the second storage system  
2   including a second host and a second storage subsystem, the first communication link being an  
3   IP network, the data path being a Fibre Channel, the first and second storage subsystems being  
4   disk array devices, the method further comprising:  
5                   storing a base journal in the second storage area that is derived from at least a  
6   portion of initial data that had been stored in the first storage area prior to the  
7   storing-data-in-a-first-storage-area step, the journal transferred to the second storage system  
8   further including the base journal;

receiving a notification at the first host from the second host via the first communication link coupling the first and second hosts, the notification informing the first host that the journal has been received by the second storage subsystem;  
transmitting an instruction to the first storage subsystem from the first host to prepare the second storage area for storing new information therein.

17. A computer readable medium for managing a data processing system, the medium comprising:

code for storing data in a first storage area in the first storage subsystem according to an instruction of the a first host that is associated with the first storage subsystem;

code for storing a journal in a second storage area in the first storage subsystem, the journal corresponding to the data stored in the first storage area, the journal including journal data and metadata;

code for informing the first host that the first storage subsystem is ready to transfer the journal to a second storage system, so that the first host can inform the second storage system via a first communication link that the first storage subsystem is ready to transfer the journal to the second storage system, the first communication link being configured to exchange management information between the first host and the second storage system;  
and

code for transferring the journal information to the second storage system via a data transfer path that is different from the first communication link.

18. A storage subsystem provided in a data processing system, the data processing system including a first storage system and a second storage system, the first storage system including a host and the storage subsystem;

a storage controller to communicate with the host that is coupled to a remote host of a remote storage system via a first communication link, the first communication link being configured to exchange management information between the host of the storage subsystem and the remote host of the remote storage system;

a first storage area to store data according to an instruction of the host of the storage subsystem;

a second storage area to store journal corresponding to the data stored in the first storage area; and

a communication interface coupled to a second communication link, the second communication link coupling the storage subsystem and a remote storage unit of the remote storage system, the second communication link being configured to transfer the journal to the remote storage unit,

wherein the storage subsystem is configured to notify the host when the storage subsystem is ready to transfer the journal stored in the second storage area to the remote storage unit.

19. A data processing system, comprising:

a primary storage system including a primary host and a primary storage subsystem, the primary storage subsystem being configured to perform an asynchronous remote replication procedure, the primary storage subsystem including a first storage area for storing data and a second storage area for storing a journal corresponding to the data;

a secondary storage system including a secondary host and a secondary storage subsystem, the secondary subsystem being configured to perform an asynchronous remote replication procedure, the secondary storage subsystem including a third storage for receiving and storing the journal from the primary storage subsystem and a fourth storage for storing data that has been restored using the journal received from the primary storage subsystem, the restored data being a copy of the data stored in the first storage area;

a first communication link coupling the primary host and the secondary host to exchange management information; and

a second communication link coupling the primary storage subsystem and the secondary storage subsystem to exchange data between the primary and secondary storage subsystems,

wherein the primary host is configured to provide management information about the journal stored in the second storage area to the secondary host via the first communication link;

wherein the secondary host is configured to instruct the secondary storage subsystem to obtain the restored data from the journal received from the primary storage subsystem upon receiving a notification that a receipt of the journal has been completed from secondary storage subsystem,

wherein the primary storage subsystem is configured to retrieve the journal from the second storage area and transfer the journal to the secondary storage system via the

26 second communication link upon receiving a data transfer request or determining a  
27 predetermined condition has been satisfied.

1                   20.           The data processing system of claim 19, wherein the primary storage  
2 subsystem is manufactured by a first vendor and the secondary subsystem is manufactured by a  
3 second vendor different from the first vendor, the first and second communication links being  
4 the same communication network.